GAS IN INDUSTRY

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FEATURES

GAS BEHIND THE T.V. SCREEN

OVERHEAD HEATING INSTALLATION COVERS 11 ACRES

CONTROL UNDER VARIABLE PRESSURE CONDITIONS WITH THE YK REGULATOR

HARROGATE GAS AT WORK IN INDUSTRY EXHIBITION. By Eric Ford.

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Editorial

G.A.W.I.I. goes North

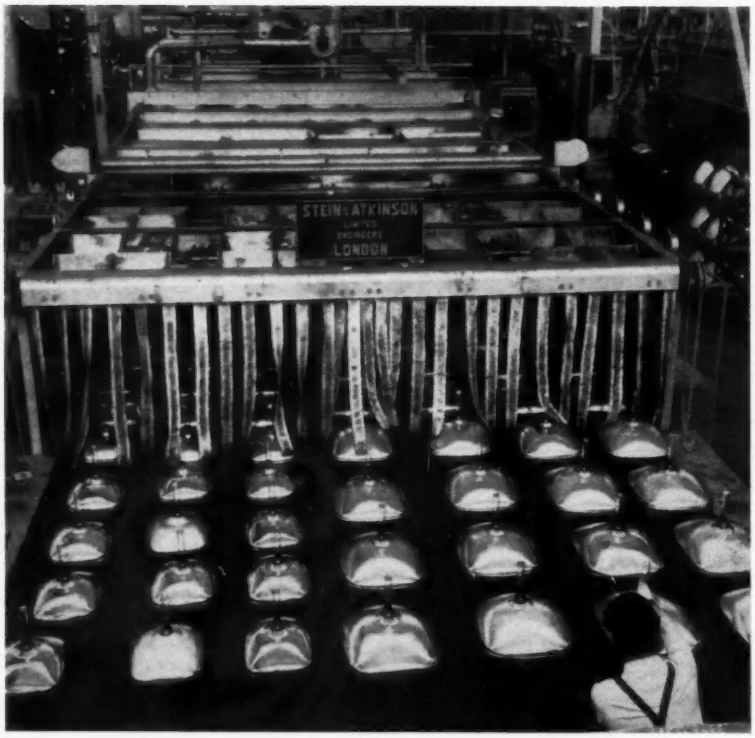
IMITATION, they say, is the sincerest form of flattery, and so the decision of the North Eastern and Northern Gas Boards to hold the Gas at Work in Industry Exhibition in Harrogate was a compliment to the Eastern, South Eastern, Southern and North Thames Boards which had sponsored the exhibition in London a few weeks previously. The success of the London show was beyond question—even *Hansard* records a tribute to its excellence—and nothing could be more natural than the North Eastern and Northern Boards' desire to bring the same evidence of the versatility and modernity of gas in industry before their consumers. In future years the exhibition may well be held in other parts of the country but it is unlikely that it will be held in the same place more often than every three years. Techniques for using gas in industry are always improving, but it is unlikely than even this most adaptable of fuels could show sufficient development to sustain an exhibition held more frequently. Nevertheless, Gas at Work in Industry is here to stay; its popularity with visiting industrialists will ensure its continuance at regular intervals.

It would be unfair to imply that the Harrogate exhibition was a carbon copy of that held in London. Many of the exhibits and features were certainly transferred, but there was in addition a great deal of new material reflecting the service which gas provides for the industries functioning in the areas concerned. For example, one of the many applications of town gas in the textile and associated industries was shown by a model of a gas-heated tentering oven using a combination of hot air recirculation and radiant heat. A second model demonstrated the use of hot air for the drying of wool hanks, etc., while a third example was a gas-fired singeing machine. Also in this section a gas-fired steam boiler used in conjunction with a steam-heated autoclave for the pleating of textile materials could be seen working.

Particularly worthy of note was a substantial section devoted to development projects by the two Boards. Here could be seen furnaceless stress relieving of pressure vessels utilising specially designed jet burners in combination with high velocity hot air recirculation to achieve stress relieving temperatures in the region of 650°C., the application of the jet burner principle for the shrinkage of pump rotors on to shafts and their expansion for removal, the furnaceless heating to a temperature of 1,000°C. of tube ends *in situ* on a flanging or belling machine, and an experimental crucible furnace incorporating recuperation of combustion air. These and other examples of development work are dealt with in detail in the review of the exhibition on p. 108.

One of the gas industry's claims is that gas is used in virually every modern industry and manufacturing process. Nothing could be more modern or more far-reaching in its effect on the country than television. Yet here is an industry which owes its existence to gas, for only gas can provide the readily controlled heat necessary for the manufacture of tubes and valves. The manufacture of these delicate products, at the Simonstone and Blackburn works of Mullard Ltd., is the subject of a special article in this issue.

GAS BEHIND THE T.V. SCREEN



This is one of the two 100-ft. long Lehr furnaces used to bake the fluorescent screen material on to the glass face-plate. The furnaces are indirectly heated by gas-fired tubes.

How gas is used in the manufacture of 1½ mill. television tubes every year in the Simonstone factory of Mullard Ltd. Wire and glass manufacture at the organisation's Blackburn plant is also described.

RADIO and television are an integral part of British life today and the production of component parts has become a major industry. In this, as in so many other modern industries, gas plays a vital part. Nowhere is this more apparent than in the factories of Mullard Ltd., the well-known manufacturers of radio and television valves.

The manufacturing plants of the Mullard Group are located in two main regions in the north and south of England. The northern plants, concentrated in Lancashire, are at Blackburn, Simonstone (near Burnley), and Southport, with a number of smaller feeder factories in Fleetwood, Rawtenstall, Lytham St. Annes and Southport. Between them the Lancashire plants, with which this article is concerned, account for about half the Group's 17,000 employees and use about 1.8 mill. therms of gas a year.

The Simonstone plant produces over 1½ mill. television tubes a year —a large part of the Group's total output. The plant, which has been described as the most modern of its kind in Europe, was built under the Distribution of Industry Act.

The production of television tubes at Simonstone begins with the component parts of the glass bulb—the cylindrical neck, the flared cone, and the rectangular faceplate.

Tube assembling

After the parts have been checked for accurate dimensions and inspected for blemishes the process of assembling them into the complete bulb begins. First, the neck is welded to the cone. This operation is performed by automatic rotary machines, of which there are six in the plant, each having 12 stations. The two parts are first pre-heated by radiant cup gas burners and gas-air burners to bring them to the correct temperature for welding, and the weld is then made by oxy-coal gas jets. Following this, the bulbs are transferred to a side sealing machine where the metal e.h.t. connection is fused into the side of the cone. The region of the seal is pre-heated by radiant cup burners and gas-air jets, and the seal is made by oxy-coal gas jets.

To remove any strains in the glass, the neck and cone assembly is annealed in an oven, which also serves to pre-heat the assembly ready for the faceplate to be joined on. Meanwhile, the faceplate is pre-heated to the same temperature in another oven.

The 24 automatic machines for welding the faceplate to the neck and cone assembly are among the most ingenious in the plant. Gas-air jets pre-heat the two component parts, and cross-fires of oxy-coal gas jets further raise the temperature of the welding region. The actual weld is accomplished by an electric arc struck through gas flames which brings the edges of the two components up to melting point, when a perfect seal takes place. With the thick glass necessary for television tubes it is

essential to heat the two components evenly to avoid strains or cracks, and to ensure this the gas jets automatically follow the contour of the face-plate, keeping a constant distance from the glass as it rotates.

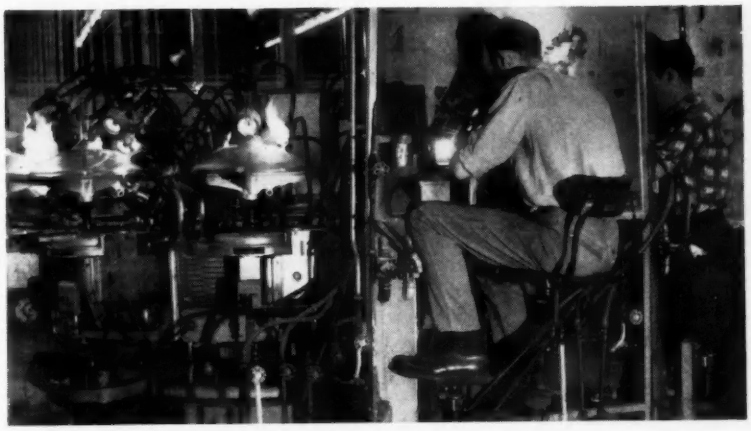
Stress removal

The complete bulb is annealed by raising it to a certain temperature and allowing it to cool slowly. This removes any stresses which would be potential weaknesses in the finished tube. The bulbs are now introduced to the extensive and elaborate overhead conveyor system that runs through the entire plant, and around which all the subsequent processes are planned. Almost two miles in length, the conveyor is laid in over 30 separate sections for flexibility. Besides carrying the tubes from one process to the next, it is actually involved in many of the operations. By arranging journeys of suitable length between processes, the conveyor is used for operations like slow cooling and drying; and it can also act as a store between processes, reducing handling costs and the possibility of damage. Furthermore, it is designed so that many operations can be performed without removing the bulbs or tubes.

The cooled bulbs are thoroughly washed with different solutions, finishing with purified water, to make ready for the vital process of laying the fluorescent screen.

The screens are layed by means of specially designed rotary mills. These are fitted with dispensers which automatically deliver the correct amount of buffer solution, water glass and fluorescent powder. As the bulbs travel round the mill the fluorescent powder gradually settles down through the buffer solution evenly on to the surface of the glass, where it is held by a gel-like formation produced from the different solutions. As they complete their journey the bulbs are automatically tilted to remove the liquid, leaving the screen deposit undisturbed. The bulbs are dried by infra-red lamps and filtered air and are then given internal coatings of lacquer and graphite, the latter to form an electrical connection between the final anode and the e.h.t. connector.

One of the automatic machines for joining together the neck and cone of the bulb. The glass parts are pre-heated by radiant cup gas burners, and the weld is made with oxy-coal gas jets.



Here, the metal e.h.t. (extra high tension) connector is being sealed into the side of the glass cone of the bulb. The pre-heating is done by radiant cup gas burners and the seal is made with oxy-coal gas jets from hand-held torches.

Film of aluminium

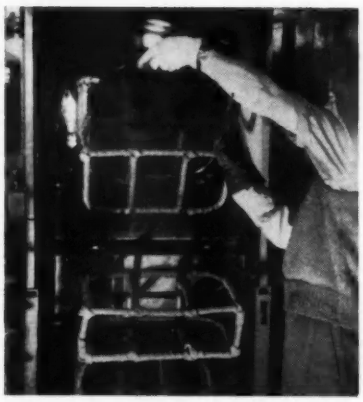
The bulb is then ready for laying a film of aluminium on the inside of the screen and cone. The film acts as a mirror behind the fluorescent screen, increasing the brightness of the picture. It also prevents the screen being damaged by heavy ions during the tube's working life. To form the mirror a small pellet of aluminium is attached to a wire filament and inserted in the bulb. Air is then removed from the bulb, and the filament heated by an electric current; the aluminium pellet evaporates in the vacuum and spreads evenly, and microscopically thin, over the inside surface of the screen and cone.

The bulbs are next passed slowly through one or two continuously operated 100-ft. long Lehr furnaces to drive off all moisture and to bake out the unwanted constituents of the various coatings, which would otherwise make it impossible to maintain the necessary vacuum in the finished tube. This baking process also fixes the fluorescent screen firmly to the glass face. The Lehr furnaces are indirectly heated by gas-fired tubes, and are the biggest single gas consuming units in the entire plant. They each have a starting consumption of 6,000 cu.ft. of gas an hour and an average hourly running load of 4,000 cu.ft. The bulbs travel through the furnaces on a 12 ft. wide conveyor belt and the whole process takes 125 minutes. The temperature through the furnaces is zoned automatically at seven points, rising from 20°C. through 420°C and back to 25°C.

Now, after a thorough inspection of the screen, using ultra-violet light, the bulb is ready to receive the electron gun. The guns are assembled in a separate part of the factory by highly trained female operators. The component parts (over 60 to each gun) are manufactured to extremely high standards of accuracy and a system of statistical quality control is applied throughout so that there is no possibility of faulty parts reaching the assembly operation. Oxy-coal gas jets are used in the assembly of the guns, to weld the glass support rods in the electrode assembly.

Electron gun sealing

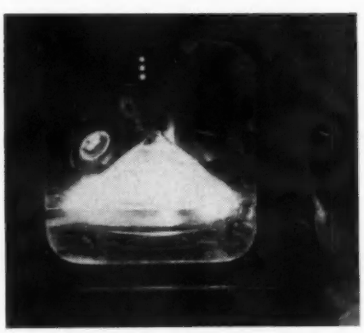
The assembled guns are checked by microscope to ensure that the spacing of the electrodes is correct. They are then washed to remove contamination before passing to the rotary sealing machines, which seal the gun, mounted on its glass base, into the neck of the bulb. Each sealing machine has 12 stations and employs radiant cup gas burners for pre-heat-



In this gas-fired conveyor oven the face-plates are pre-heated prior to joining them to the neck and cone assemblies to form the completed bulbs.

ing the region of the joint and oxy-coal gas jets for the actual seal. The positioning of the gun in the neck is critical and everything depends on the accuracy of the machine and the correct adjustment of the gas flames.

From this operation the tubes are transferred to the pumping machines where air is withdrawn from the bulbs and the internal components degassed to create the necessary very high vacuum. Each tube is pumped by an individual pumping trolley and while the air is being removed the trolley carries the tube through a long heated tunnel. This heating process drives off any gases present in the metal electrodes, the glass bulb, or the screen materials. At the same time, an electric current is passed through the heater to give the cathode the necessary emissive properties.



This is one of the automatic machines for welding the faceplates to the neck and cone assemblies. Gas-air jets pre-heat the components and their temperature is further increased by cross-fires of oxy-coal gas jets. The weld is accomplished by an electric arc struck through the gas flame. To ensure even heating and to prevent strain in the glass the gas jets automatically follow the contour of the faceplate as the bulb rotates.

These operations completed, the getter is 'fired' by induced high frequency currents. (The getter is necessary to trap the last traces of gas remaining in the tube and any which may be released during its working life—so maintaining the vacuum at a high standard.)

Rigorous tests

The tube is now connected to power supplies and its internal metal components are bombarded by electrons from the cathode to stabilise its performance. It is then subjected to a series of rigorous tests under working conditions to ensure its high performance and reliability; and at this stage the quality control department selects batches of finished tubes at regular intervals and subjects them to extensive tests. By comparing the results of successive tests, any trend away from the high standard of performance required can be quickly detected and rectified before quality is adversely affected.

★

Assembling the electron gun. The operator is welding the glass support rods for the tetrode and lens assembly by means of oxy-coal gas burners.

★

The Blackburn plant

The major part of the Blackburn plant is engaged in the manufacture of receiving valves, chiefly for radio and television. Apart from the mica spacers and the nickel used for some electrodes, all the components for the many different types produced are made within the plant from the raw materials.

The basic components of a valve are: The electrodes, comprising heater, cathode, anode and, excepting diodes, one or more grids; the glass envelope and base; and the internal supporting members, mica spacers and insulators. These various component parts are fabricated in separate units of the plant and brought together in the large assembly bays where skilled operators build up the complete valves.

The cathode of the valve, the electrode that provides the emission of electrons, consists of a central core of nickel tube, round which the emissive coating is sprayed. The nickel tubing is re-drawn in the plant's wire drawing unit to the very small dimensions required in cathodes, which may scale only 0.75 mm. by 0.65 mm., with a wall thickness of 0.05 mm. The emissive coating, a mixture of barium and strontium carbonates in a volatile solvent, is sprayed on under careful control to ensure a coating of uniform density and thickness. Inside the central tube of the cathode is inserted the heater, or filament. This consists of a spiral of very fine tungsten wire formed into a 'V' or 'M' shape and coated with aluminium oxide to insulate it electrically from the cathode. The manufacture of heaters and cathodes calls for great delicacy and refinement to ensure high standards of performance and long life in the finished valves.

The grids of the valves are essentially flattened spirals of very fine molybdenum wire wound on stiff 'backbones' or supporting rods. They are wound automatically on precision winding machines in lengths of about 4 ft. at a time, and each length is then cut into individual grids of appropriate size.

Anodes are pressed to the required shape and size by automatic machines from nickel, nickel-plated steel or aluminised steel, depending on the type of valve.

In the assembly bays deft-fingered operators, assisted by ingenious mechanical aids, assemble the electrodes into a 'cage,' ready to be mounted on the base. The base is a small disc of glass holding the connecting pins, by which the valve plugs

Machines of this type have been developed for welding together the component lengths of the tri-metal connecting wires, which comprise the stiff external connecting pins, a special type of wire to form a perfect seal with the glass base and the connecting wire between this and the various electrodes. Gas jets heat the metals for welding.

in to the valveholder and a corresponding number of wires to which the various electrodes are connected. Joining the stiff metal pins and the thinner connecting wires is a third length of wire which has the same overall coefficient of expansion as the glass, and which therefore ensures a perfect airtight seal where the wires pass through the glass.

The machines that make the bases automatically feed the correct number of tri-metal connecting wires into a jig. A collar of glass is placed round the wires and the whole assembly is revolved. As it rotates, gas flames soften the glass collar and the machine gently presses it into shape around the centre sections of the tri-metal wires. Special machines then cut the connecting wires into the right lengths and bond them to the exact positions for the electrodes to be welded to them.

Creating a vacuum

Once the electrode cage has been joined to the base, the next steps are to seal the assembly into its glass envelope and then to evacuate the air to form the vacuum necessary to the operation of the valve. Substantial quantities of gas are used in these operations. In the first, gas jets are employed to soften the glass at the junction of the base and the envelope before the sealing machine automatically applies the correct pressure to form the joint; and in the second for pinching off the pumping stem once the air has been removed. Twenty-four rotary pumping machines, each capable of handling 30 valves at a time are in operation.

While the valve is being pumped, the metal components inside are heated by induced high frequency currents to drive out any gases which may have been absorbed during manufacture. A current is passed through the heater to reduce the cathode coating to oxide, thus forming the electron emitting surface, and induced heat is again used to evaporate the getter to absorb the last traces of gas. When the valve has been removed from the machine it is operated for a period under controlled conditions. During this period changes occur in the cathode coating resulting in improved emission.

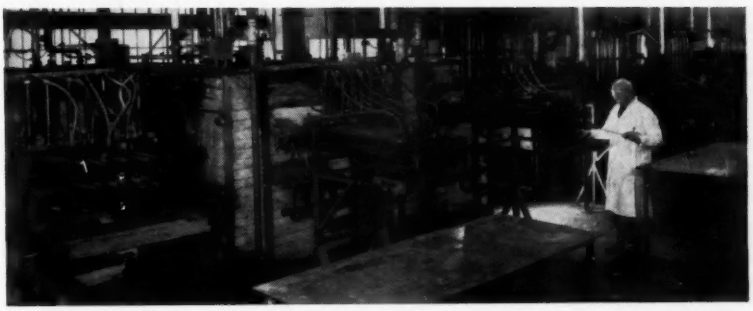
Batch testing

Finally, the valve is put through a succession of exacting tests covering its operating characteristics, emission, vacuum, insulation and so on. In addition to these routine tests, the quality control laboratory continually tests batches of valves selected at random from the production line. Any falling off in quality is detected at the earliest possible moment, so that steps can be taken to correct it before the trouble can assume serious proportions.

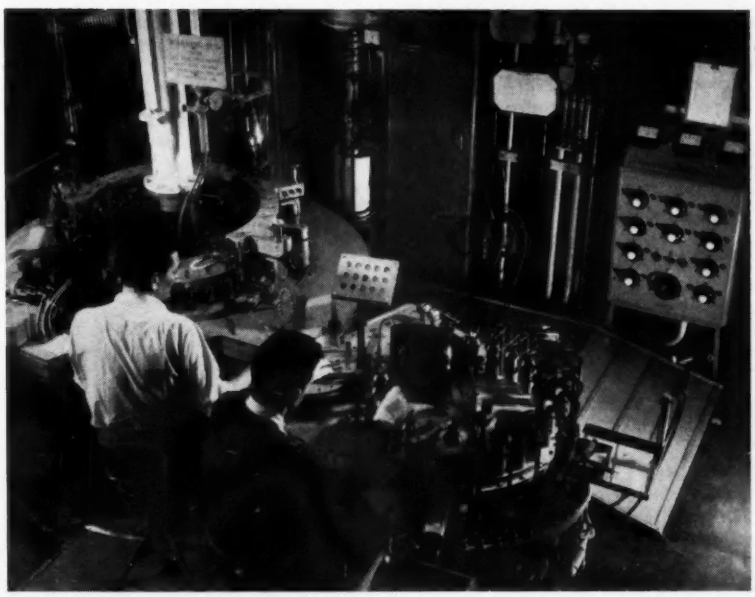
Wire manufacture

A large section in the Blackburn plant is given over to the manufacture of tungsten and molybdenum wire. Much of this appears as grids and filaments in the millions of valves produced each year by the plant. But a substantial amount is supplied to other manufacturing industries for a variety of purposes.

The annual output of wire exceeds



The reducing furnaces, heated by gas, where the tungsten and molybdenum oxides are converted to metal powder in the manufacture of fine wire.



One of the rotary pumping machines which remove the air from the valve envelopes to create the necessary vacuum. Gas jets are used for sealing the base to the envelope and for 'pinching-off' the pumping stem once the air has been removed.

a quarter of a million miles, enough to circle the earth ten times. Most of it is incredibly fine; the finest has a diameter of five thousandths of a millimeter, which is finer than any spider's web and ten times as thin as a human hair.

Like most other components of Mullard valves, the wire is made in the plant from start to finish. Even the diamond dies used in the final drawing stages are made by the company's own craftsmen.

Tungsten occurs naturally in the tungstates of iron, magnesium and calcium. It is the latter, known as scheelite, that is used at Blackburn. The quality of scheelite available from various world sources varies greatly, and skill and experience are necessary in its selection. Molybdenum is obtained from molybdenite ore, the chief deposits of which are in the American continent, Norway and Yugoslavia.

Tungsten

The following brief account of wire making concentrates on tungsten, but the production of molybdenum follows a broadly similar pattern, with variations dictated by the chemical differences in the two ores.

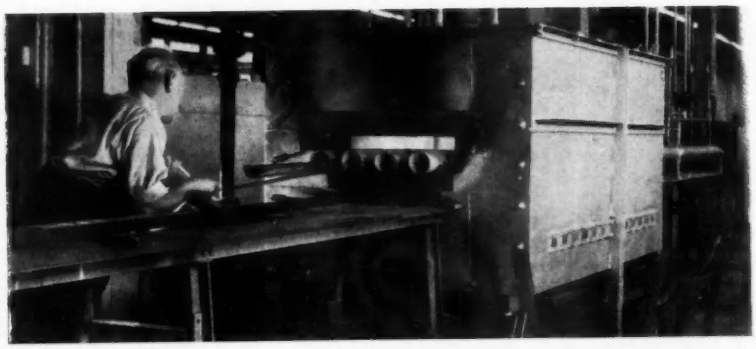
First the scheelite ore is put through chemical tests to ensure its quality, after which it is ground continuously for several days in a ball mill. The resulting very fine tungsten oxide powder is purified chemically, and placed in reducing furnaces where, in a hydrogen atmosphere, it is converted to tungsten metal powder. The reducing furnaces, which run up to 900°C., are gas burning. Controlled amounts of special additives are introduced into the pure powder to control its crystal structure and to prevent the finished wire sagging, and the powder is then compressed into bars of convenient size.

Sintering processes

Next come sintering processes which crystallise the compressed powder into a hard metal, ready to be made into wire. Sintering is done by first heating the bars in an atmosphere of hydrogen and then passing through them an electric current of between two and three thousand amperes.

Now begins the process of converting the sintered bars into wire of the required thickness. The first step is swaging, in which the bars are raised to white heat and then hammered in successive stages until they take the form of thin rods. Gas furnaces are used to heat the bars prior to hammering.

The tungsten rods are drawn through a series of progressively smaller dies until they have been reduced to the thickness required. Drawing occurs in three main stages: First on a chain bench, next on large diameter drums, and finally on smaller drawing heads. In each stage a number of dies are used, carefully spaced to achieve a gradual reduction in diameter and, at the same time, to increase the strength and ductility of the wire. Hard metal dies are used in the initial stages, but as the wire becomes thinner diamond dies are necessary. Gas is used extensively throughout the drawing operations, for heating the wire before it is pulled through the dies and also in the annealing furnaces through which the wire passes at predetermined intervals to remove strains.



At pre-determined intervals during the manufacturing process, the wire is annealed to remove strains.

Testing for accuracy

Once the required diameter has been obtained the wire is put through a series of strict tests and inspections to check its dimensional accuracy and mechanical properties. Often it is so fine that its diameter can be measured only by accurately weighing it against a standard length.

Glass-making unit

Glass figures so largely in the manufacture of radio and television valves that the glass-making unit at the Blackburn plant is virtually a factory in its own right, producing from the raw materials over 14,000 miles of glass tubing every year. While most of this is absorbed by the plant's valve-making units, a significant proportion is worked into envelopes for the millions of semi-conductor devices made annually in the company's southern production centres and into necks for the television tubes made at the nearby Simonstone plant.

The manufacture of glass requires large quantities of heat, and gas is used extensively throughout the unit, both in the production of the glass and in the working of it into component parts.

Clear, faultless lead glass is necessary for valve, tube and transistor manufacture; so to the basic in-

The canteen kitchens at the Mullard television tube plant, Simonstone, use substantial amounts of gas in providing a round-the-clock meal service for the employees.

gredients of red lead, sand, and sodium and potassium carbonates are added other chemicals carefully selected to improve the quality of the finished product. All these ingredients are weighed into hoppers and automatically mixed. Water is added to bind the powders, and the hoppers are marshalled above the furnaces ready for their loads to be fed into the glass melting tanks, which are maintained at a temperature of about 1,500°C.

From these tanks, the ingredients, now fused into liquid glass, are poured automatically into a gas-heated holding and feeding furnace which contains rotating tube-forming machines. From these machines the glass is drawn vertically in tubular form by a process of great ingenuity.

In the centre of each machine is an inverted cone through which air is blown at low pressure. The molten glass runs round the cone and is drawn straight up from the centre, forming a tube round the upward jet of air. By adjusting the cone size and the air pressure the inside diameter of the tubing can be varied accurately to particular requirements from, for example, 1.5mm. for transistor envelopes to 50mm. for television tube necks.

As the newly-formed tubing rises it passes through a circle of air jets which keep it perfectly round and control the thickness of the tube wall. These jets are adjustable so that an exact wall thickness can be obtained and maintained throughout production. In a room 25 ft. above the furnace floor, machines grip the tubing and draw up the endless column of hot glass. Operators cut the tubing into suitable lengths as it rises and weigh each piece to ensure that it meets the required specification. The diameter of each length is checked by gauges and the wall thickness by micrometer. For each of its uses the glass tubing must meet exacting size specifications; even a variation of a few tenths of a millimetre is unacceptable.

Following these tests the tubing is cut to size and finished, ready to be worked into the various component parts required.

The production of glass tubing is a continuous process that goes on night and day, year in, year out. The melting furnaces are never extinguished, except for periodic maintenance, in which case standby furnaces take over. A reliable supply of gas at the right pressure is therefore essential to the operation of the entire glass-making unit.

The annual consumption of Mullard's Blackburn plant is 750,000 therms. This is 10% of the total annual supply to the whole of Blackburn town and its close neighbour Darwen.

The above article was produced as a result of a Press visit arranged by the Gas Council in conjunction with Mullard Ltd., and the North Western Gas Board.

Overhead heating installation covers 11 acres

THE biggest industrial application in Britain of overhead gas radiant heaters will shortly be completed at the Birkenhead shipbuilding works of Cammell Laird & Company.

The installation, two-thirds of which is already in operation, warms a working area of 11 acres of plating and welding bays housed in a single building with a roof height of 60 ft.

Enclosed building

Much of the work which was previously done in the open, or at most with simple overhead shelter, is now performed inside a fully-enclosed building at a comfortable temperature of 55°F. Here sections of ships weighing anything up to 100 tons are prefabricated and carried out onto the open slipway by giant gantry cranes which can run the whole length and breadth of the building over the bays.

Schwank heaters

The heat is provided by 480 six-unit Schwank high-temperature gas radiant heaters fixed at intervals along the stout horizontal crane-supports, 22 ft. above the ground. These give an even temperature at floor level, and are equipped with thermostatic control.

A special feature of the installation is the ease with which any selected floor area can be warmed independently of the others. Clock controls automatically ignite and shut off the whole system at the required times in the day, and also ignite the heaters over any selected area or areas, if overtime is being worked there.

The annual gas consumption in normal working hours is estimated to be about 350,000 therms—more, if overtime is worked. The system was proposed by the Wirral section of the North Western Gas Board's Mersey Group, who won the contract against keen competition from tenders incorporating a variety of oil and coal burning systems. The Schwank heaters are manufactured by Parkinson Cowan Industrial Products Ltd.

CONTROL UNDER VARIABLE PRESSURE CONDITIONS WITH THE YK REGULATOR

A NEW regulator for industrial boiler installations has recently been introduced by Teddington Industrial Equipment Ltd. of Sunbury-on-Thames, Middlesex. Known as the YK furnace pressure regulator, it is designed to operate in conjunction with damper motors and thus regulate induced and forced draught fan-dampers in response to variations in furnace pressure.

Normally supplied complete with the Teddington ZB model damper motor, the YK is a simple and effective combustion control link incorporating the advantages of an adjustable differential control point and response rate, which can be selected to maintain close control under variable conditions.

The instrument is calibrated in three ranges, i.e., 0 to −1.5, +0.75 to −0.75, 0 to +1.5 in. w.g., and employs a diaphragm-operated floating change-over contact which can be used for the on/off control of one or two motors as required. Minimum differential is 0.25 in. w.g. adjustable to a maximum of 0.20 in. w.g., and response rate is variable from 0.75 seconds to ten seconds.

Movement of the YK diaphragm in response to small changes in furnace pressure will actuate the associated damper motor, thus opening or closing the dampers to restore the desired depression across the combustion chamber. The contact arm returns to the mid-off position when this satisfactory condition is reached and the dampers remain stationary until a further pressure change occurs.

G.A.W.I.I. GOES NORTH

Harrogate exhibition shows that gas is alive to the needs of modern industry

THERE is hardly an industry in the north of England which does not make use of gas. The gas load is distributed throughout the many industries of this heavily industrialised region, particularly heavy consumers being the processing of non-ferrous metals and alloys, shipbuilding, general engineering in its heavy, medium and light ranges, glass and textiles.

A clear indication of the ubiquitous applications of gas in the north was seen at the Gas at Work in Industry Exhibition which was held at Harrogate from March 28 - April 1. Organised by the North Eastern and Northern Gas Boards, this was an entirely new event and the first of its kind to be held outside London. Although a few of the exhibits had been seen previously at the London Gas at Work in Industry Exhibition, its scope had been extended and in particular the two Boards collaborated in presenting a section devoted to a number of outstanding research and development projects which are being carried out in their respective regions.

Development projects

On the stand devoted to these development projects, the emphasis was on new or modified equipment and processes suggested by actual industrial needs rather than on fundamental research. In other words, the equipment on show on this stand had been designed to solve a definite problem, thus underlining the service which the gas industry gives to its consumers, in addition to the obvious one of maintaining a sufficient and reliable supply of gas for industrial use.

A typical example is the equipment which has been designed for the stress relieving of large cylindrical vessels, without the use of a furnace. In recent years, the need for all-welded pressure and other vessels has increased with the consequent greater necessity for efficient stress relieving. If this is to be carried out in a furnace, very large furnaces are required and, in addition, there is the problem of man-handling the vessel from the assembly shop to the furnace, which may well be in a different works.

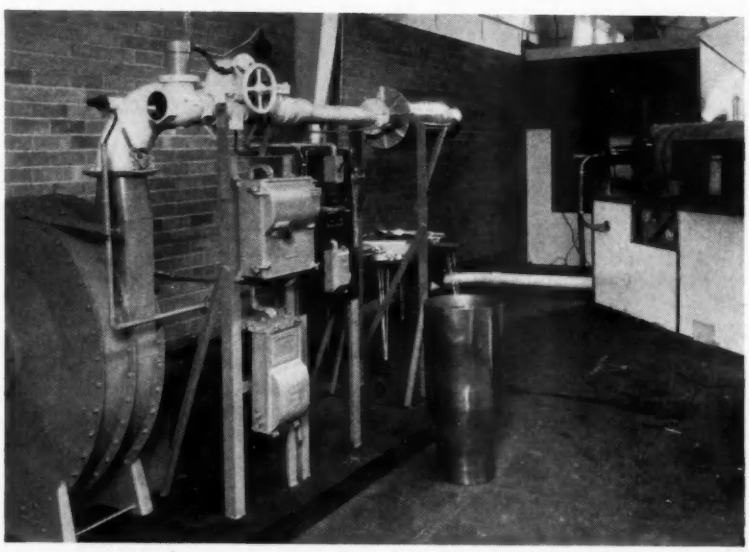
Accordingly, 'furnaceless' stress relieving has been employed, using electricity, either by placing radiant elements along the base of the vessel or wrapping heating elements round the wells while the application of insulating materials round the vessel prevents heat loss. The Bradford Industrial Development Centre of the North Eastern Gas Board has developed a technique in conjunction with Clayton, Son & Co. Ltd. of Leeds, for providing furnaceless stress relieving of pressure vessels using high velocity jet-type gas-fired burners. A one-sixth scale model of the process was shown in action on the stand, together with one of the actual burner equipments which was used in the stress relieving of a vessel 46 ft. in length, 9 ft. in diameter and weighing approximately 21 tons. Plate thickness was $\frac{7}{8}$ in. shell and 1 in. end-plates.

One of the problems of heating the whole of a vessel of this type is that it has few access holes and, in fact, the vessel for which the North Eastern Gas Board process was originally designed had only one means of access, which was a hole of 18 in. diameter, 6 ft. from one end.

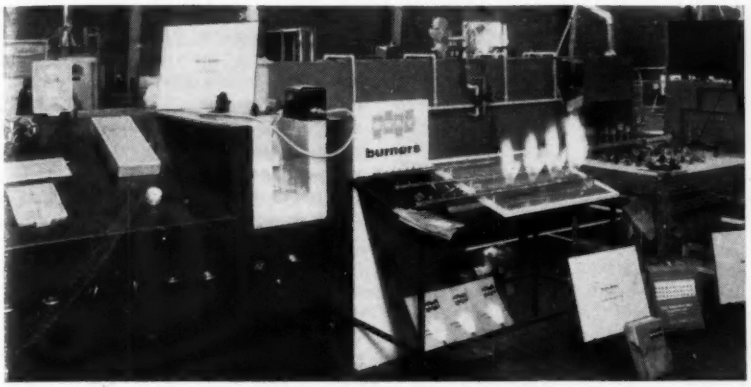
Difficult to meet B.S.S.

Apart from other considerations, it is extremely difficult to meet the temperature differential requirements of B.S.S. 1500. Among the methods considered was fan-assisted circulation but difficulty of access ruled this out. The method adopted relies upon entrainment of waste gases within a mixing tube by a high velocity jet of products. The mixing tube is sited inside the vessel, running along its length at one-third centre. The calculation of orifice sizes in the mixing tube depends largely upon the weight of the vessel served by each hole, although a certain fall off in temperature and pressure of the heating gases makes it necessary to provide some 30% increase in area at the end remote from the burner.

It is necessary to record the temper-



One of the most impressive exhibits at the Gas at Work in Industry Exhibition at Harrogate was the equipment designed by the North Eastern Gas Board for the furnaceless stress relieving of large vessels. In the foreground can be seen the high velocity jet burner used in this operation while in the rear is the scale model of the lagged boiler with the burner in position at the side.



Burners are an essential part of gas-fired equipment. Prominent in this picture are some of the burners on show at Harrogate.

ature of the vessel at not less than 15 ft. centres and the method used is the welding of steel blocks to the vessel itself. Two holes in these blocks then carry the thermocouple wire, the junction being formed between the steel block and the separate wires. By the use of this method, extremely reliable results and continuous ten-point recording was carried out throughout the heating and cooling periods.

Overcoming unevenness

Any unevenness in heating can be overcome by manipulation of gas and air supplies to the burner. For example, if the temperature at the burner end of the vessel rises above that at the other end, heat can be transferred from the high temperature zones to the cooler points by shutting off, or reducing, the gas supply to the burner, while the air supply is kept constant. By this manipulation, a differential of 100°C., when arriving at a stress relieving temperature, can be readily reduced to less than that required under British Standards procedure.

Overall length of the burner used in this operation is 28 in. with an exit port of 4½ in. Air supply pressure is 40 in. with a capacity of 1,000 cu.ft. per min. Maximum gas capacity is 7,000 cu.ft. per hour with an approximate jet speed of 400 m.p.h. The recirculating tube is 15 in. diameter with discharge holes 3-3½ in. diameter along its length and 6-9 in. end discharge.

'Rocksil' insulation 4 ins. thick was used to lag the vessel and proved extremely satisfactory in operation. It required seven hours to reach 600°C. and the approximate gas rate was 4,200 cu.ft. per hour, giving a cost per ton of 9s. 7d. With electricity, heating cycles of up to 30 hours are employed and a normal cost of 16s. to 19s. per ton is usually incurred during the stress relieving process.

It is estimated that the insulation material cost approximately £280, plus £75 for its application and the installation of the centre tube.

Another interesting application of the high velocity jet-type burner which has been developed by the North Eastern Gas Board is in the glass industry, where one of the big problems is the drying of the brick-lined 'tanks' used in glass production. In addition to being difficult of access, temperature control is critical during the warming-up period. Furthermore, the refractory material can be dried out more evenly in this way, with very little temperature differential between the hearth and crown of the tank. The glass container industry is an important one in the area covered by the two Boards and there is clearly a bright future for a method of drying which, in addition to the above advantages, cuts down considerably on time and drastically reduces losses due to cracked bricks.

A good example of another application of high velocity techniques was demonstrated at the exhibition in the form of specially-designed equipment for pre-heating boiler tubes prior to flange rolling.

In this equipment, developed by the North Eastern Gas Board, the tube is placed on a rotating platform and the burner assemblies are lowered over the upper edge of the tube. (For the demonstration, two burners are used, but it is envisaged that three will be used to achieve really high temperatures.) The tube thus rotates in the path of the products issuing from the burners.

Pre-heating boiler tubes

Burners used are of the high velocity jet type which employ convergent tunnels but rely on radiation from the brick structure around the burner tunnels as the main means of heat transfer. This reduces the quantity of diluent air which is drawn in by a high velocity jet stream with the accompanying coating effect upon the work piece. Another good feature of this equipment, which was clearly seen from the exhibit on the stand, is that the heat is applied to a uniform depth from the top edge of the tube throughout its circumference.

This equipment lends itself well to semi-automatic methods of production. For instance, when the edge of the tube has been raised to the required temperature, the burner equipment can be mechanically raised and swung clear when the forming rollers are brought into position to run the flange on to the tube.

Using this equipment, it is possible to raise the tube to 950°C. in about five minutes, representing a vast improvement over alternative methods, apart from the great improvement in operational techniques which are employed.

Another equally interesting example of the way in which equipment is being designed by the gas industry to meet the special demands of industry was seen on the Development Projects stand in the form of a circular jet burner. This has been designed to heat shrink a boss on to a solid shaft approximately 6 in. diameter and to use the same burner to heat the boss quickly in order to remove the boss from the shaft, as required at several stages in the manufacturing process of this particular component.

To meet this problem, the Indus-

Eric Ford provides this review of the GAS AT WORK IN INDUSTRY exhibition recently held at Harrogate

trial Development Centre of the North Eastern Gas Board designed a high velocity circular jet burner which burns gas at the rate of 1,200 cu.ft. per hour. The heat is evenly distributed round the boss and shaft which are held vertically between the burner ring.

This burner, which is of fairly simple design, is constructed of two identical halves (with the exception of the gas input point) which are bolted together. Each half of the burner consists of a cast iron circular channel with a refractory ring insertion. When the two halves are bolted together, the cast-iron channels form the gas burner manifold and the refractory rings form the burner tunnel. The burner is fed from a 1-lb. air supply and low pressure town gas via an inspirator giving a mixture pressure up to 10 in. w.g.

In operation, the high velocity of the burner removes the surface film of gases on the outside of the boss giving good heat transfer to the metal. The boss quickly expands and within two minutes can be slipped on to the shaft where it shrinks on cooling to give a tight sealed joint. To remove the boss, the gas burner is fitted over the boss and shaft in line with the shrunk-fit portion of the boss. At a gas rate of 1,200 cu.ft. per hour the heat is forced into the metal of the boss very quickly. The molecules of gas trapped between the inside edge of the boss and the outside edge of the shaft tend to retard the transfer of heat to the shaft allowing the boss to expand quicker than the shaft. The resistance to heat flow between the boss and shaft increases, accelerating the difference in expansion between the boss and shaft. The boss comes free of the shaft after less than two minutes heating and can be readily removed.

Model salt bath

One of the most attractive exhibits on the Development Project stand, both from the point of view of design and potential use, was the half-scale model salt bath, fired by gas. This piece of equipment has been designed by the North Eastern Gas Board for the treatment of wire by immersion of the product in a heat treatment salt.

Existing salt bath techniques, in the temperature range 550°C. to 750°C., employ a cast-iron pot, externally fired, in which the work is handled in baskets. Larger tanks are used in lower temperature operations and these are externally fired or heated b electric immersion tubes. Recognisin that the need exists for the design o a highly efficient gas-fired salt bath c much larger dimensions than thos normally used, the Industrial Develop ment Centre has designed this usefu piece of equipment.

A rectangular bath contains the sal solution and the bath is fitted with a cover which can be easily drawn aside to permit the entry or exit of coils of wire for treatment. The cover is fitted with flanged wheels running on rails on either side of the bath. The temperature of operation of the bath is maintained within the range 650-720°C. according to carbon content by automatic temperature and proportioning control. The combustion air is supplied to the burner system, preheated to a temperature of some 500°C., thereby returning what would otherwise be waste gas to the salt bath. The gas and air are burned at nozzle mixing burners within stainless steel tubes. There are two of these and they run down and across the bottom of the bath on divergent routes, rising to an exit point at the diagonally opposite corner.

Alongside the salt bath a pre-heating chamber is sited which imparts 200°C.

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pre-heat to the entering load of wire, wound on a spindle. The heat for this purpose is derived from the main heating system and after providing the pre-heat, air is returned to the burner system as already described.

In this way, the maximum degree of heat recovery with a thermal efficiency of the order of 70% can be obtained, making the process more than competitive with a similar process carried out on other fuels. The use of the stainless steel tubes also ensures the rapid melting of the salt without fear of explosion.

A careful examination of this half-scale model on the stand revealed not only its technical effectiveness but also its obvious capacity for incorporation into flow-line production methods, which is one of the most important virtues of most types of gas-fired equipment in view of industry's current urgent need for greater productivity. By means of some appropriate overhead system, coils of wire for treatment could be brought to the pre-heat chamber and lowered into it. On completion of pre-heating, the coil could be raised from the chamber, the cover of the bath could be slid back and the coil moved into position above the bath and lowered into it. Almost at the same time, a new coil could be placed in the pre-heat chamber and the cover replaced on the bath.

Although designed for the treatment of wire, there is no doubt that this promising piece of equipment could be easily applied to the many other dipping processes requiring heat which are widely employed throughout industry.

Prototype crucible furnace

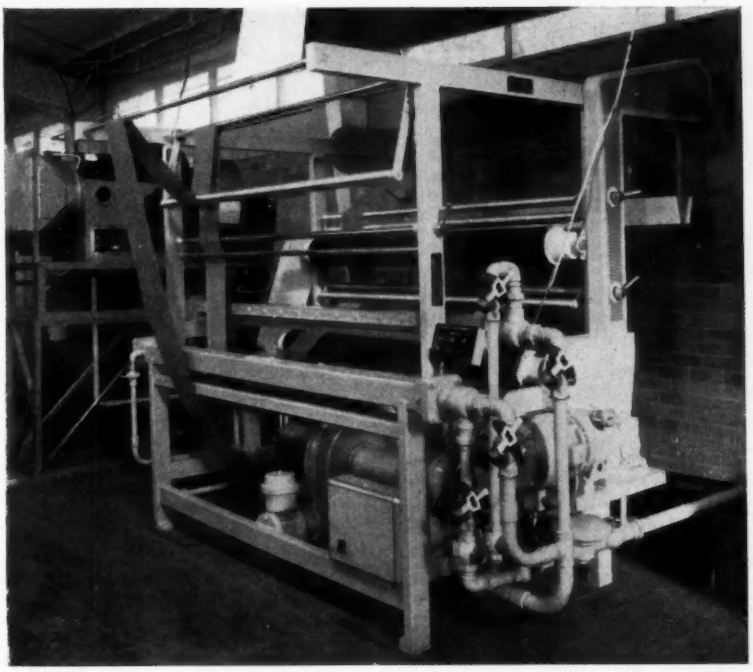
Among the other exhibits on this extremely interesting stand was a prototype crucible furnace also developed by the North Eastern Gas Board. This has evident applications in the foundry industry in which gas has a long association, particularly, perhaps, in the melting of brass and aluminium. By using pre-heated air, higher melting speeds at an even higher efficiency than usual can be obtained and the prototype furnace embodies this feature. Moreover, forced evacuation of the products of combustion gives cleaner atmospheres within the foundry and a more easily controllable atmosphere for melting.

A visitor to a Gas at Work in Industry Exhibition would not normally expect an Oriental flavour, but the Northern Gas Board demonstrated the 'Chinese' cooker which they have developed to meet the needs of the Chinese restaurants in their area. The special type of Chinese cooking vessel is in the shape of a shallow metal bowl which, of course, will not rest on the normal Occidental gas-fired hot-plate. Accordingly, the Board has developed a special type of cooker, in which ring burners are set at the appropriate distance below the level of the stove top which is supplied with circular holes of diameters to suit the sizes of the cooking vessels.

Other equipment on show by the Northern Gas Board include the 'Y' burner, which is being made up in the Board's workshops and represents perhaps the simplest but most effective air blast burner. It has many applications and is widely used throughout the Northern Gas Board area. Applications on show on the Development Projects stand included the drying of foundry ladles and the lighting of cupola furnaces.

A miniature jet burner of an experimental type has been developed by the Northern Gas Board for special applications where high heat concentrations on very small areas are required, as in the tool room and, perhaps, in certain assembly operations.

In addition to the 'live' displays of development work, all of which could be seen in operation, either full-size or scaled down, a pictorial display gave the visitor an idea of the very wide range of specialised development work which is in hand in the two regions covered by the North Eastern and Northern Gas Boards. This work was illustrated on the walls of the central lounge where the visitor could examine pictures of the pre-heating of Tropenas converters, cupola lighting, the heating of mobile solution tanks, the drying of large steel plates for the shipbuilding industry, prior to sand blasting, the brazing of copper flanges (up to 22 in.) on copper tubes, the smokeless ignition of specially designed gas-fired igniters in Lancashire boilers and the drying of articles of different sizes for solution treatment.

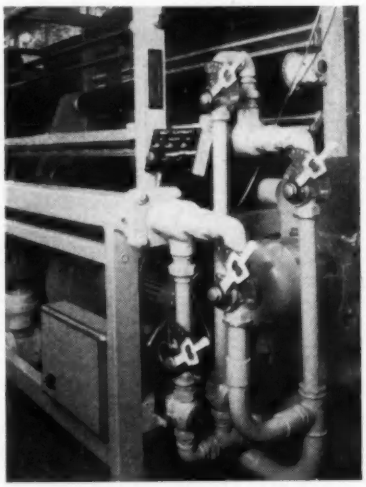


Making its first appearance at any exhibition was this ribbon flame singeing machine for the textile industry, manufactured by James Bailey (Engineers) Ltd. The ribbon flame is sited to the left of the control panel and runs across the machine.

Gas in textiles

Although the gas load for the textile industry is not one of the largest in the region, it is an industry which has always been associated with the north and the amount of gas used in textiles is steadily growing. From the equipment on display at the exhibition on the Gas in Textile Processes stand it would appear that the prospects for an increasing use of gas in textiles are bright.

Heating is required in the textile industry for many drying purposes and it is in these applications that gas has many advantages. An interesting



Close-up of the ribbon flame singeing machine showing the controls and gas supply arrangements.

model plant on the stand, shown by the North Eastern Gas Board demonstrated the various ways in which gas can be used for tentering, using a combination of hot air recirculation and heat.

From information received on the stand, it was readily appreciated how gas can boost production in such fields as the drying of latex on the backing of carpets or the carbonising of terylene. One method of applying heat is to pass the material horizontally on rollers between two Schwank burners, placed above and below the material and in opposition to each other. The material passes through the space between the burners and receives even heating. There may be occasions when the production line has to be halted and, if no precautions were taken, the material would soon be scorched. On one production line in the Board's area, two safeguards against scorching have been incorporated. By means of an appropriate system of controls, a stoppage of the movement of the cloth between the burners results in the cutting off of the heaters while, on another piece of equipment, the shutting off of heaters is supplemented by the introduction of two asbestos sheets between the heaters and the cloth, the control and movement of the sheets being automatic.

Ribbon flame singeing

On the Textile Processes stand, Jas. Bailey (Engineers) Ltd., Huddersfield, showed a ribbon flame singeing machine in action. It is recorded that flame singeing of cloth was one of the first applications of gas in textiles some 100 years ago and it is interesting to learn that this process, after being less popular for a period, is now coming to the fore again.

In the machine on show, the roll of cloth is continuously unwound and in the process it passes across a ribbon of flame extending horizontally across the width of the machine. The width of the flame itself is easily controlled, depending on the width of the cloth to be singed. This machine, which has not previously appeared at an exhibition, is capable of singeing one or both sides of most textile fabrics. Because of the precise control over the flame, it is claimed that it is virtually impossible to scorch the fabric.

Gas is advantageous in this application because of its simplicity and speed of operation, the ease with which the width of the flame can be controlled, the effectiveness of the flame cut-out control and the minimum of maintenance required. A very important feature is the fact that maximum heat is immediately available.

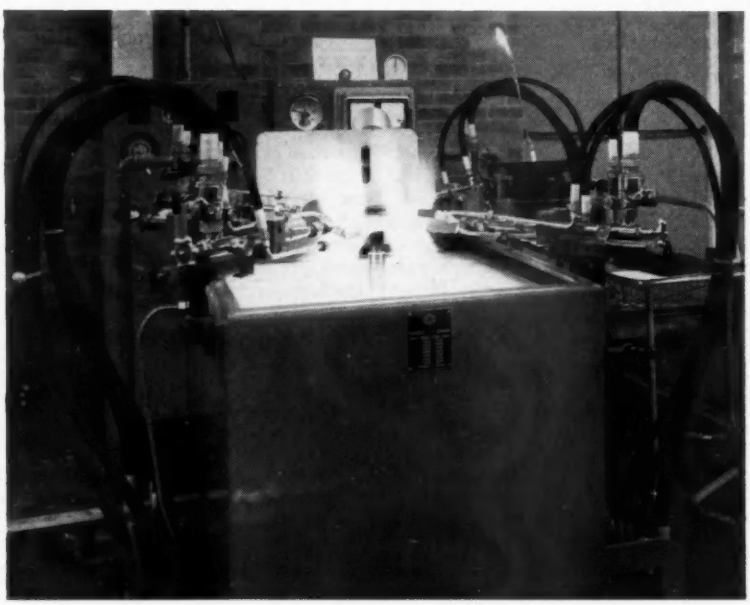
Vacuum steaming plant

A vacuum steaming plant, by Sanderson & Co. (Textile Engineers) Ltd., for the setting of twist or killing liveliness in yarns of all types where the maximum temperature required does not exceed 200°F. was also shown on this stand. The machine comprises a yarn container mounted within a welded mild steel framework which bears the control panel. A vacuum pump and motor is mounted at the rear of the panel. At the end of each steaming cycle, a drying factor ensures that no condensation forms on yarns or bobbins when the door of the container opens, a particularly desirable feature when dealing with woollen and worsted yarns. Drying-off is achieved by removing all surplus steam from the yarn vessel and circulating hot air before opening the door.

Entirely automatic

This machine is entirely automatic and, once set, will reproduce the same steaming conditions for each successive batch of yarn. Each cycle is fully recorded. The vertical controlled flame gas-fired boiler used in conjunction with this operation was supplied by Controlled Flame Boilers Ltd., London. The boiler, with a pressure of 125 p.s.i., is fitted with automatic gas and water controls and low water alarm.

On the stand devoted to flame hardening and cutting, the London firm of Surfard Ltd. showed the fully-automatic gear hardening machine, using the recently perfected spin hardening method which created great interest at the London Gas at Work in Industry Exhibition. The equipment on show has been ordered by one of the best-known automobile and tractor manufacturers in the United Kingdom. The gear to be



Flame hardening of the teeth of gear wheels is here seen in progress on the new spin hardening unit by Surfard Ltd. On completion of the heating cycle, the gear is plunged automatically into the quench below.

hardened is spun on a central spigot while gas burners play on the teeth and at the end of a pre-determined time, the gear or pinion is automatically plunged into the quenching liquid below.

Gear hardening

Another example of an automatic oxy-town gas gear hardening machine was shown by Surfard Ltd., namely, the Type ZV1,000, suitable for spur gears up to 6 ft. diameter and a tooth width of 9 in. The gear is supported on a vertical spigot and the burners and quenches, operated by a master cam, rise over the width of the tooth. At the completion of the hardening stroke, the burners are extinguished automatically and lifted clear of the gear, which then automatically moves round to bring the next tooth in line with the path taken by the burners and quenches. The burners, having returned to the starting position, are automatically re-ignited and the cycle is repeated.

A recent refinement on this machine is the incorporation of a control mechanism by which the number of teeth to be treated can be pre-set into the machine, which stops automatically when this point is reached.

Cutting machines

British Oxygen Co. Ltd., London, have long been associated with the cutting of steel by oxy/town gas flames, and showed four machines from their large range at Harrogate. These included a 36-in. Universal cutting machine for the small workshop, a B.I.G. Cub profile machine, which can be changed from automatic to manual operation in a few minutes, a Bantam cutting machine, an all-purpose tool for the fabrication shop and the Alyn tube profiling cutting machine. Demonstrations on the stand showed the value of oxy-town gas cutting processes for speedy, convenient and versatile cutting and shaping of steel. These advantages are particularly marked in the production of shapes in preparation for welding or when making profile cuts in blades, slabs or forging.

Foundry applications

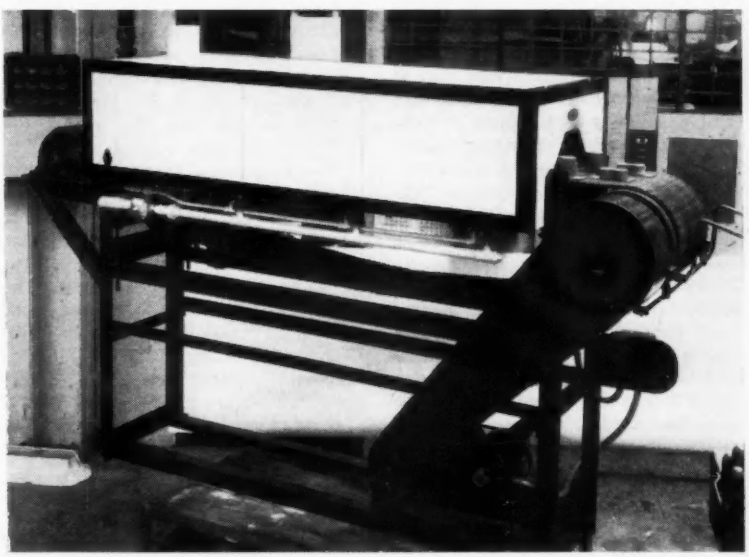
Gas has many applications in the foundry, including such ancillary tasks as core drying and the production of shell moulds, as well as metal melting.

Core drying was demonstrated at Harrogate by the Mastertherm continuous core oven, supplied by Radiant Heating Ltd., London. This oven has been designed to replace the traditional batch-type core stove in mechanised or semi-mechanised foundries. In addition to reducing drying times by up to 50% and gas consumption by 30%, this oven is described as semi-portable. The cores being baked in this oven incorporated 'Supinol' rapid baking core oil 314, supplied by F. & M. Supplies Ltd., London, specialists in foundry chemicals.

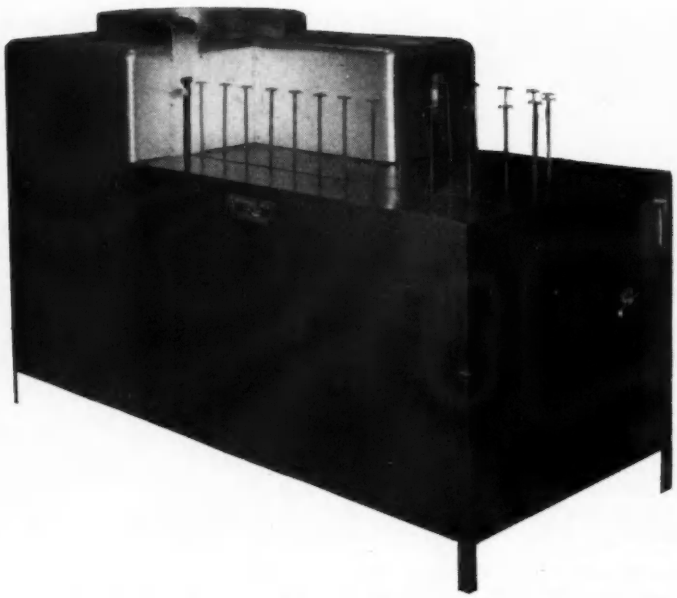
Another unit for use in supplying hot air for foundry use (as in drying mould) was the gas-fired portable hot air drier, made by Modern Furnaces and Stoves Ltd. This unit, the Axial Jet-M, weighs 180 lb. and is fitted with spark ignition and flame failure equipment.

Shell moulding is a technique which, if not exactly new in foundry practice, is certainly increasing its range of applications. A shell moulding machine by Fairburn Lawson Combe Barbour Ltd. was shown at the exhibition. This Leeds firm demonstrated their Mark II machine which is gas-fired, subjected to thermostatic control and fitted with temperature indicator. The pattern plates (effective area 24 in. by 16 in.) are turned mechanically on to the dump box by pressing a button

A demonstration of oxy-town gas cutting of steel on the stand of the British Oxygen Co. Ltd.



Mastertherm continuous core drying oven supplied by Radiant Heating Ltd



A conveyorised fusing furnace by Stewart Gill & Co. Ltd., as demonstrated at the Harrogate Exhibition for enamelling badges. The operators were the well-known firm of Fattorini & Son Ltd., Birmingham.

once the pattern plates have been engaged with the dump box cross bar. An electronic timer device covers the thickness of mould required. A foot pedal operates the ejector, leaving the operator's hands free for handling the mould.

Reverberatory melting furnace

A reverberatory melting furnace was shown by A.G.M. Industries Ltd.

Many gas-fired heat treatment furnaces of all types are in use in industry and it was possible to show only a selection at the Harrogate exhibition. A great deal of this equipment had also been seen at the London Gas at Work in Industry Exhibition, but the small general purpose bar or pipe heating furnace by the International Furnace Equipment Co., Ltd., of Newcastle-upon-Tyne, had not previously been shown at any exhibition. This furnace, with a 'C' type cantilever roof, has many applications, including the heating of pipes or steel sections for bending, spring heating for nibbing and eye-forming and pipe tagging. The lining is in semi-insulating refractory, aimed at quick heating and, in fact, working temperatures can be reached in 15 minutes.

Barlow-Whitney Ltd., London, exhibited one of their recent products. This was a heavy-duty batch furnace for general heat treatment processes to temperatures of 1,200°C. and fired by the Barlow-Whitney type CR tunnel burner.

Annealing small pressings

For the annealing and heat treatment of small pressings and similar components, the gas-fired continuous wire mesh conveyor muffle furnace by Dowson & Mason Ltd., Manchester, can also be used for brazing and sintering. The furnace is, however, primarily intended for heat treatment in a prepared atmosphere and is capable of an output of 80 lb. per hour at temperatures around 800°C. The maximum gas burner capacity is 400 cu.ft. per hour and this is capable of raising the furnace from cold to the operating temperature in 1¼ hours.

One of the advantages of using town gas as a fuel in this furnace is that as a result of the low sulphur content of this fuel, the life of the muffle is greatly extended.

Two continuous furnaces using prepared atmospheres which were also shown at Harrogate were the shaker hearth furnace for case hardening or surface carbon correction, by British Furnaces Ltd., Chesterfield, and the rotary retort furnace for treating small parts by Thermic Equipment & Engineering Co. Ltd., Preston—Gibbons Applied Atmospheres Ltd., Birmingham.

Both these furnaces were fully described in the last edition of *Gas in Industry*.

Visitors to the London exhibition who were impressed by the demonstration of the applications of gas in vitreous enamelling and paint curing were glad to note that these two important features of process finishing were prominently displayed at Harrogate. The Incandescent Heat Co Ltd., Smethwick, showed their continuous furnace, fired by incandescent tubes, as used for the vitreous enamelling of badges and similar small enamelled ware.

Radiant tubes

This company's Jetubes (high recirculation radiant tubes) have already made a considerable impact on the industry. The flexibility of the Jetube gives a very wide temperature range and the furnace on display can work at temperatures between 550 and 830°C.

Large continuous Jetube-fired furnaces are now producing top quality enamelled ware with a high output and a flexibility hitherto unknown in fusing furnaces. The Jetube system has already been used for heating tinplate strip in the first high speed continuous annealing line at the Velindre Works of the Steel Company of Wales, as well in such other applications as gas carburising furnaces, bright annealing and bright brazing furnaces, catalyst drying and for heating soaking pits for aluminium.

In association with the well-known firm of Fattorini & Son Ltd. a new conveyorised pre-heating and fusing plant by Stewart Gill & Co. Ltd., Slough, was seen in action enamelling badges. Visitors were able to see the entire process, including the cleaning and bright dipping of the metal stampings, the application of enamel, firing and glazing, the removal of excess enamel by linishing and assembly. Gas is particularly suitable in this application because of the high heat transfer rates, uniformity of temperature and the ready introduction of conveyorised techniques.

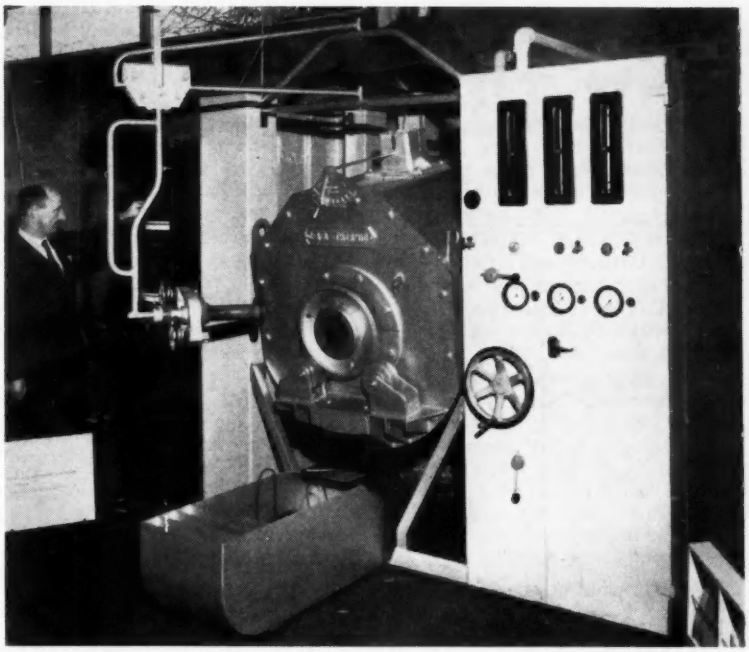
Reference should also be made to an interesting piece of ancillary equipment used in this process, namely, the 'Hippo' wet bandfacer, which was recently introduced to the badge-making trade by the RJH Tool and Equipment Co. Ltd., Heckmondwike. This machine employs special waterproofed abrasive bands on to which a fine jet of water is sprayed, the cooling effect of which prevents cracking of the filling and helps to give a fine finish.

In the field of paint stoving, gas-fired equipment offers many advantages. A very good example of this was on show in the form of a 12-panel gas-fired radiant heat oven, fitted with automatic electronic pyrostat temperature control by Parkinson Cowan Industrial Products, London.

This plant was engaged in stoving toy industry products after spraying in a water-wash spray booth, supplied by the Aerograph-DeVilbiss Co. Ltd., London.

This was a continuous operation, the conveyor arrangement being of the overhead type, supplied by Teleflex Ltd. Stoving in box ovens was also demonstrated. The equipment included a standard tray-loading box oven, fitted with explosion relief and flame failure device, by Barlow-Whitney Ltd., and another box oven by F. J. Ballard & Co. Ltd., Tipton.

For the heat treatment and curing of articles requiring comparatively low temperatures, the present trend is to employ hot air recirculating ovens of the type shown at Harrogate by J. L. S. Engineering Co. Ltd., Redditch. Fitted with explosion relief flaps and flame failure apparatus, the oven on show was capable of operation at 750°C. with a temperature uniformity throughout the entire working space of ±1°C. The inner lining is of 10g. heat resisting steel plate with mineral wool insulation to give maximum insulation with low thermal storage.



Rotary retort furnace for the heat treatment of small parts, manufactured by Thermic Equipment & Engineering and Gibbons Applied Atmospheres.

Direct-fired air heater

There are many applications in industry where gas-fired equipment can be used for drying or warming. A new type of direct-fired air heater unit was shown by A. E. Griffiths Ltd., Birmingham. This unit, which is fitted complete with air delivery fan, is intended for sale eventually in three sizes.

In addition to the applications of gas in the actual production lines of industry, this flexible form of fuel is being increasingly employed in the various services, such as heating and the supply of hot water, which are indispensable for the efficient functioning of the modern factory. Other important industrial services include canteen facilities and incineration and gas finds many important applications here as well. All these aspects of the industrial gas field were well represented at the Harrogate exhibition.

For instance, the increasingly popular overhead radiant heating system was represented by a number of prominent firms including Bratt Colbran Ltd., Parkinson Cowan Industrial Products, Radiant Heating Ltd. and Harris Engineering Ltd. The advantages of overhead heating systems include space saving and flexibility as well as fuel efficiency.

Other types of heater on display included the new Walmer convector fire by Bratt Colbran Ltd., Wembley, and DRUgasar 2500 by F. A. Borchardt Ltd., London, one outstanding feature of which is that it has a completely sealed combustion chamber which is not opened even for lighting.

Gas-fired air heating has many advantages for use in both the factory and home and units with outputs ranging from 20,000 B.t.u. to 400,000 B.t.u. per hour were shown by such firms as William Sugg Ltd., Bratt Colbran, Paragon (Leeds) Sheet Metal Co. Ltd., Harris Engineering Co. Ltd., Waterbury Ltd. and Powell Duffryn Modulair Ltd.

Large housing projects

Of particular interest was the scale model showing the growing importance of gas as a form of fuel for the large housing project. Gas has been selected as the sole fuel for cooking, space heating, hot water supply and home laundering for six 12- and 15-storey blocks of flats (totalling 468 homes) in Newcastle, and a similar contract for six 15-storey blocks of flats (540 homes) will also be gas-equipped.

Details were also given of multi-storey flats at Gateshead where the SE-duct principle was first used in multi-storey flats in Great Britain. This system is not only cheaper to instal but also permits the use of room sealed appliances. Another important feature is that the CO_2 concentration within the flue system does not exceed 2% so that a gas-burning appliance can draw the necessary air for combustion from this flue while at the same time discharging its products of combustion into it. The base of such a system is connected to a horizontal duct which runs the entire width of the building and this permits the entry of a continuous supply of fresh air for combustion and dilution purposes.

Incinerating waste

It is perhaps not as widely realised as it should be that gas-fired appliances are available for incinerating the waste in offices and factories. There are various types of incinerator and those on show at the Exhibition included a cloakroom incinerator by Southalls Ltd., Birmingham, and the type 3708 incinerator manufactured by William Sugg & Co. Ltd., London. Other firms showing on this stand included Bratt Colbran Ltd., R. & A. Main Ltd. and Radiant Heating Ltd.

Catering on a large scale, as in the domestic kitchen, is quite definitely the province of the gas industry. A number of well-known gas catering appliance manufacturers loaned equipment for display including Cox Ovenbuilders Ltd., Leamington, who showed the two-deck Regal Two single degree oven of the completely portable type, and the Ellerstyle Engineering Co. Ltd., London, whose exhibits included steam boilers,

doughnut cookers and deep frying units.

Water heating

An allied product is the water heater which is used in all canteens and kitchens as well as in industrial cloakrooms. A range of this equipment was shown, including the Main Water Heaters Ltd., Apollo multi-purpose instantaneous gas water heater and equipment by Radiation Ltd. and Ascot Water Heaters Ltd. Other related equipment included a Dawson Bros. Ltd. dish washing machine and a small externally gas-fired degreasing tank by Neil & Spencer Ltd. Other firms represented on this stand included Adams & Son (Engineers) Ltd., Sidney Flavel & Co. Ltd., Jackson Boilers Ltd., Maxol Heaters Ltd., and Smith & Wellstood Ltd.

Space heating

A large number of gas-fired boilers for use in conjunction with industrial and commercial space heating systerms were also on display, testifying to the growing importance of this gas application. Among those firms whose products were displayed were many of the best-known names in this sphere, including F. Kay (Engineers) Ltd., Vulcan Boilers Ltd., Thomas Potterton Ltd., International Boilers Ltd., Ideal Boilers and Radiators Ltd., and Thomas Potterton Ltd., who showed the Diplomat 66.

Industrial burners

One of the most striking features of the gas equipment industry is the calls it makes on many vital components and services which are rarely noticed. Burners, for example, can more often be heard than seen while their presence is more evident from the heat they emit than because they are readily visible. It was therefore a good idea to devote a section of the Exhibition to various types of industrial burners. In addition to the impressive exhibit assembled by the North Thames Gas Board, high pressure burners of various types were shown by Keith Blackman Ltd., jet burners were displayed by Barlow Whitney Ltd., while George Bray & Co. Ltd. showed aerated burners of the flat flame type.

Burners by these and other manufacturers were also incorporated in the other equipment throughout the exhibition and, in the same way, many manufacturers had contributed instrumentation devices and ancillary equipment of all kinds such as recorders, controllers, flame failure devices, fans, compressors and the like. Among the firms represented in this way were the Accurate Recording Instrument Co. Ltd., Broom & Wade Ltd., Ether Ltd., Honeywell Controls Ltd., George Kent Ltd., Metropolitan Gas Meters Ltd., Negretti & Zambra Ltd. and, no doubt, others as well.

To assemble all this equipment and to display it to such good advantage was no mean feat on the part of the two Gas Boards who jointly sponsored this successful exhibition. Some 200 tons weight of equipment was brought to the exhibition hall and assembled in seven days. About 2,000 ft. of piping had to be laid and fitted and the services laid on included gas at normal pressure and air supplies from ½ to 100 p.s.i. Oxygen supplies had also to be made available. Extensive electrical wiring was necessary and it is estimated that the total electrical load was about three times that required for one of the normal exhibitions for which this Harrogate centre is notable.

Natural exercise

An exercise of this sort comes naturally to the gas industry which has long been accustomed to supplying a comprehensive service to its many satisfied industrial consumers. From the evidence of the Harrogate Gas at Work in Industry Exhibition, it is clear that the North Eastern and Northern Gas Boards will continue to maintain this service in the years ahead.

A West Midlands 'special'

BOARD'S PLASTIC WELDING TORCH REDUCED COSTS

SPECIAL town gas burners have been designed by the Worcestershire/Herefordshire Divisional Industrial Department of the West Midlands Gas Board, for a firm manufacturing plastic lined steel vessels of various types.

There were two main types of torch previously in use by the firm. The first was a large butane fuelled natural draught blow lamp, which was used primarily for heating the outside of the steel tanks, to give a good bond on the adhesive holding the plastic lining in place on the inside of the tanks.

After tests on various types of burner it was decided to use a simple neat gas burner head on the end of a heat insulated handle, with a shield to guard the operator's hand against back lash of the flame.

Easier in use

In use, this type of torch was found to be more satisfactory and easier to use than the butane torch, as the low temperature-spreading, neat gas flame of the town gas torch enabled the area being heated to be covered more quickly, with less risk of local overheating and consequent burning of the plastic and bonding compound.

The second type of torch to be replaced was considerably more complex. A small acetylene burner was used to heat a coil of stainless steel, which acted as a heat exchanger, to produce a jet of hot air for welding the plastic. It was not possible to use a flame for this purpose as the plastic material scorched above about 200°C.

Close control

Eventually a very small air blast burner with a flame-retaining head was designed. Cocks were incorporated in the handle of the torch to enable a close control to be maintained on the heat input to the torch and also the volume and temperature of hot air. It was thus sufficiently flexible to enable several different grades and thicknesses of plastic to be welded without danger of scorching the lighter gauges.

This torch had also proved more satisfactory than the acetylene model it replaced because it was not subject to the formation of carbon which had reduced the serviceability of the acetylene torches.

The most significant advantages were shown in running costs, the fuel costs for the process being several times cheaper on town gas than on the bottled gas. It is believed this is the first time that town gas has been successfully applied to this type of work.